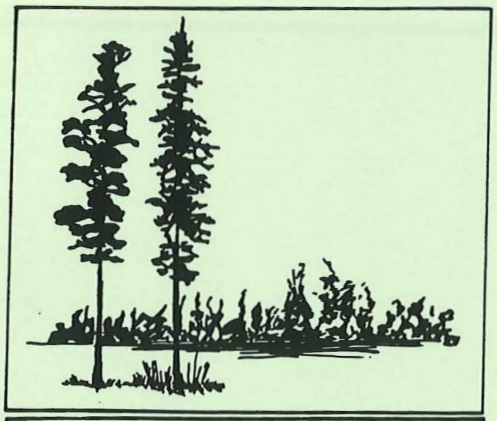
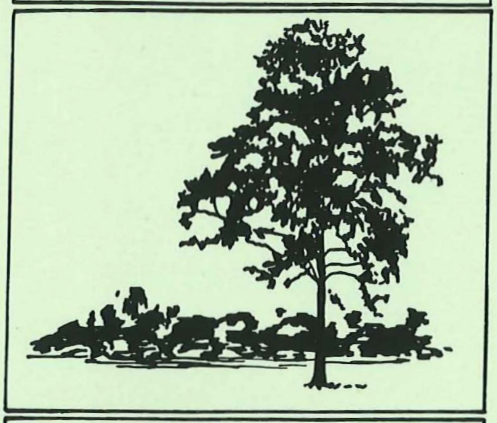




DEPARTMENT OF NATURAL RESOURCES
BOX 7921
MADISON, WISCONSIN 53707

FOREST PEST CONDITIONS IN WISCONSIN

ANNUAL REPORT 1991

FOREST PEST CONDITIONS IN WISCONSIN ANNUAL REPORT - 1991

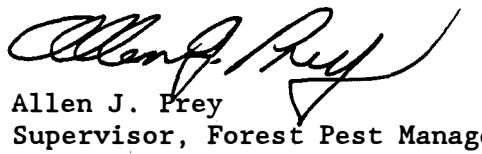
Compiled and Edited by Allen J. Prey,
David J. Hall, and Jane Cummings Carlson

DEPARTMENT OF NATURAL RESOURCES
Division of Resource Management
Bureau of Forestry

ACKNOWLEDGEMENTS

This record of the activities of forest pests and other destructive agents of growing trees in Wisconsin's forest nurseries, plantations, and natural timber areas was made possible by the dedicated work of pest management personnel in each district and at the Forest Pest Management Laboratory in Madison. Department of Natural Resources foresters, other Department field personnel, cooperators in other public agencies and private forest industry contributed valuable assistance in monitoring the forest lands in all classes of forest ownership.

Preparation of this Annual Report was a result of a team effort involving William Kearby and Shane Weber, DNR District Entomologists who submitted district reports. Jane Cummings Carlson and Dave Hall, Forest Pest Unit, Madison, consolidated the district reports and wrote the final draft using personal computers. Mark Guthmiller and Lynda Billoto, Limited Term Employees, prepared the computer-generated and hand-drawn maps, and Katherine Severson, Southern District Program Services, completed the word processing. Final printing was done by the DNR Bureau of Program Services.



Allen J. Frey
Supervisor, Forest Pest Management
June 30, 1992

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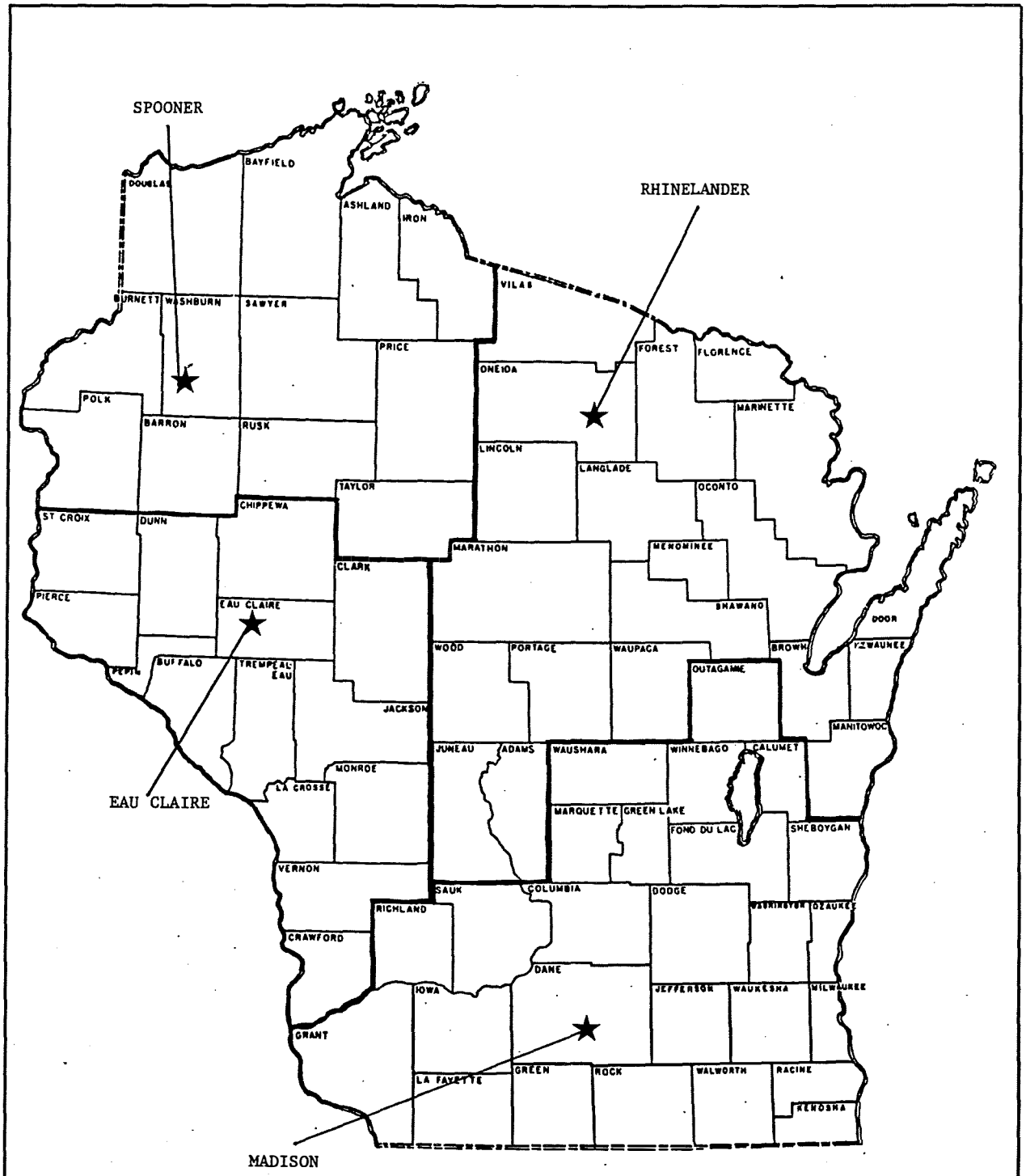

Figure 1. Station locations of Wisconsin Department of Natural Resources District Entomologists and Forest Pest Unit Personnel.

DEPARTMENT OF NATURAL RESOURCES
Forest Pest Management Personnel - December 31, 1991

Name	Title	Address	Telephone
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Weber, Shane D.	Forest Entomologist	DNR, Box 309 Spooner, WI 54801	(715) 635-2101

INTRODUCTION

This report lists the major insect and disease problems reported on forest land in Wisconsin in 1991. While the report does not list all the insect and disease problems that occurred on forest land, it does highlight major or noteworthy insect infestations and disease occurrences including abiotic damage to trees.

In 1991, insect and disease detection surveys were conducted on 6 million acres and evaluation surveys on another 4.5 million acres. In addition, Wisconsin DNR district entomologists and forest pest staff continued to teach integrated pest management principles to Wisconsin DNR foresters, industrial foresters, and private woodland owners. District forest entomologists and forest pest unit staff provided a wide variety of programs and information on forest pests in 1991.

IPM DEVELOPMENT PROJECTS

The IPM program for Wisconsin Christmas Tree Producers continued in 1991. Rose Kachadoorian, University of Wisconsin-Extension and Jane Cummings Carlson, DNR, trained two IPM Christmas tree scouts who surveyed 260 acres on 14 Christmas tree plantations in central Wisconsin. Also, Dave Hall and Allen Prey staffed a diagnostic booth at the Wisconsin Christmas tree producers summer meeting in Milwaukee on July 12, 1991.

Dave Hall cooperated with the U.S. Forest Service on a red pine seed orchard IPM program to test pheromones as a tool to monitor populations of seed and cone insects in red pine seed orchards.

Dave Hall wrote a draft of a handout entitled "How to Prevent or Minimize Gypsy Moth Damage to Your Oak Woodlot."

OUTREACH

Dave Hall gave a presentation on weed control in CRP tree plantings for the UW-Extension Pest Management Conference in Madison on January 17, 1991.

On January 19, 1991, Bill Kearby gave a presentation on "Status of Forest Insect and Disease Problems in Northeastern Wisconsin" to the Green Bay chapter of WWOA (205 people).

On January 25 and 26, Bill Kearby attended a Wisconsin Christmas Tree Producers winter meeting and identified insect and disease specimens.

In February, Jane Cummings Carlson taught forest disease management for the Pesticide Certification Program, coordinated by the University of Wisconsin-Extension.

Dave Hall also wrote a new handout that summarizes forest pest management and gave a forest pest management presentation to a forestry class at Fox Valley Tech School on April 18, 1991.

Also in April, Jane Cummings Carlson taught University of Wisconsin-Stevens Point students Integrated Pest Management strategies for red pine.

On May 15, Bill Kearby gave a lecture on "Forest Insect and Disease" to Fox Valley Technical College students.

On June 12, 1991, Dave Hall gave a gypsy moth presentation to Marinette Area foresters in Marinette and to Western District foresters in Black River Falls in November, 1991.

Also on June 12, Bill Kearby reviewed the oak pest management situation in Crivitz, Wisconsin.

During June, Jane Cummings Carlson led a field trip for 10 plant pathology students through southwestern Wisconsin. Various forest insect and disease problems were viewed and discussed.

On June 15, Bill Kearby gave a Gypsy Moth presentation at the Whitefish Dunes Park Naturalist Center.

Bill Kearby and Allen Prey conducted Pest Management Training for new DNR foresters at Trout Lake Forestry Headquarters on July 23.

Dave Hall and Allen Prey staffed a gypsy moth display at Wisconsin Society of American Foresters Meeting at Eau Claire on September 10 and 11.

Dave Hall attended a WWOA annual meeting and gave a Gypsy Moth presentation in Madison on September 21, 1991.

In September, Jane Cummings Carlson conducted a field trip for the University of Wisconsin-Madison forest insect and disease management class.

Jane Cummings Carlson attended an oak regeneration workshop in November in southwestern Wisconsin. This workshop was sponsored by the USDA Forest Service.

Bill Kearby also gave field training to Wisconsin forestry students at the Kemp Biological Station on

September 21 and attended a North Central Forest Pest Workshop in Cable, Wisconsin on September 24 and 25.

Dave Hall gave a weed control presentation at a reforestation conference at Wisconsin Rapids on October 1 and 2, 1991.

On October 11, 1991, Dave Hall presented "Your Friends, the Insects" to 90 third-graders at Evansville Elementary School.

Dave Hall also gave a Gypsy Moth presentation to Lake Michigan District foresters at New London on October 21, 1991.

In November, Jane Cummings Carlson gave a presentation on oak wilt management to Black River Falls area forestry personnel.

Dave Hall gave a presentation on weed control in CRP plantings to a Green Bay meeting of USDA - Soil Conservation Service District Conservationists and DNR foresters on December 19, 1991.

Also during December, Jane Cummings Carlson gave a lecture on forest nursery diseases to the forest insect and disease management class at the University of Wisconsin-Madison.

ARTICLES

Dave Hall wrote an article on poison ivy control for Wisconsin Woodland Owners Association magazine, "Woodland Management."

Jane Cummings Carlson wrote an article for the April issue of *Wisconsin Natural Resources* entitled, "Stand by Your Plan." This was an article for woodland owners on how to recognize the common insects and diseases in their woodlots and set a strategy to manage them.

In March, Bill Kearby presented a paper entitled "The Balsam Gall Midge" to the Wisconsin Christmas Tree Growers Association's quarterly journal.

In June, Bill Kearby presented a paper entitled, "Balsam Twig Aphid" to the Wisconsin Christmas Tree Growers Association's quarterly journal.

VEGETATION MANAGEMENT

Competing vegetation continues to impact new plantations. Lack of knowledge by landowners and failure to take timely weed control measures add up to significant but unmeasured losses in terms of tree mortality and growth loss. Consequently, a heavy demand continues for information on weed control and herbicides.

Selected DNR foresters and pest managers attended the University of Minnesota, Vegetation Management Cooperative's Annual Field Tour to learn the latest in weed control in northern forests. The first annual Southern Wisconsin Forest Vegetation Management Field Tour was held in Richland and Vernon counties on July 31. Over 50 DNR consulting foresters visited 5 locations, all dealing with young hardwood and conifer plantations.

The 1991 edition of "Herbicides for Forest Management" were updated and published. A new fact sheet, "Walnut Tips - Weed Control" was written by Dave Hall and published as a University of Wisconsin Extension publication. A new table, "Tree Planting Herbicides," was written and distributed.

TRAINING

In February, Jane Cummings Carlson, Dave Hall and Bill Kearby attended a "Spray Operations Training" course sponsored by the USDA Forest Service. This course is designed to train pest management personnel the important factors involved in setting up an aerial pest management spray program.

Also in February, Jane Cummings Carlson updated the pesticide guidelines for Wisconsin Forest Tree Nurseries.

On February 8, 1991, Bill Kearby attended the U.S. Forest Service Aerial Safety Training.

On March 13, 1991, Bill Kearby attended a Photography Workshop on Techniques on Slide and Other Media Materials in Rhinelander.

On March 21, Bill Kearby attended an Androc Pesticide Update in Wausau.

On June 17, 1991, Bill Kearby attended Private Forestry training in Antigo.

Dave Hall attended a one-day Paradox database software training session in Madison on July 22.

On July 23, Bill Kearby attend ELF Training, Trees for Tomorrow.

On October 16 and 17, Bill Kearby attended Oak Regeneration Training at the Nicolet National Forest and gave a talk and field demonstration on the use of backpack spayers.

Dave Hall attended an oak management training workshop in Dodgeville on November 11.

COMMITTEES

Jane Cummings Carlson served on the planning committee for the midwest region conference entitled "Human Resources - Natural Resources, Diversity for Success." This conference offered a variety of concurrent sessions addressing the issues related to diversity in the field on natural resources.

In April, Jane Cummings Carlson attended a planning meeting in Morgantown, West Virginia on the implementation of the Forest Health Monitoring Program in the USDA Forest Service Northeastern Area. Jane is serving on the planning committee.

Bill Kearby lectured about forest insects to 105 youth corps students located on the Northern Highland American Legion State Forest.

Allen Prey served as a member of the DNR global climate change committee.

On September 19, Bill Kearby attended a Forestry Program Review at North Central District.

On October 1 and 2, Bill Kearby attended a workshop on Artificial Regeneration at Griffith State Nursery.

In November, Jane Cummings Carlson attended a research review of the forest pathology project at the USDA North Central Forest Experimental Station in St. Paul, Minnesota.

MEETINGS

In January Jane Cummings Carlson attended the winter meeting of the Wisconsin Christmas Tree Growers Association and moderated a session on pest management in Christmas trees.

The Forest Pest Management staff attended the U.S. Forest Service State and Private Forestry State Cooperators Meeting on March 5-7.

In August, Jane Cummings Carlson attended the American Phytopathological Society Meeting in St. Louis, Missouri. She conducted a field trip of Missouri's major forest disease problems, served as chair-elect to the forest pathology committee, and gave a paper entitled "Ash Crown Condition and the Incidence of Ash Yellows and Other Insects and Diseases in Illinois, Iowa, Missouri, and Wisconsin."

Also on September 23-25, Wisconsin hosted the North Central Forest Pest Workshop at Cable, Wisconsin. Shawn Weber chaired the conference and Wisconsin DNR forest pest staff assisted with the program and local arrangements.

Dave Hall attended the National Gypsy Moth Review Meeting in Raleigh, North Carolina on November 4-7.

Dave Hall continued his membership on Wisconsin Woodland Owners Association Education Committee and attended several meetings. (date??)

Allen Prey and Jane Cummings Carlson attended the first annual Midcontinental Forest Nursery Pathologist's Meeting in St. Paul, Minnesota on October 16 and 17.

PEST MANAGEMENT ORGANIZATION AND OPERATIONS

Dave Hall purchased Procite, a computer information retrieval program for personal reprint libraries, and started entering reprints on it.

ANNUAL REPORT - 1991

ASH

Ash Yellows - Mycoplasma Like Organism (MLO)

Ash yellows was not observed in any new locations in 1991. There are 4 known locations of ash yellows in Wisconsin (Figure 2). Both green ash and white ash have been observed with the yellows symptoms in Wisconsin.

Mountain Ash Sawfly - *Pristiphora geniculata* (Hartig)

Moderate to heavy defoliation of ornamental mountain ash occurred in Langlade, Lincoln, Oneida, Vilas, Washburn and Sawyer counties.

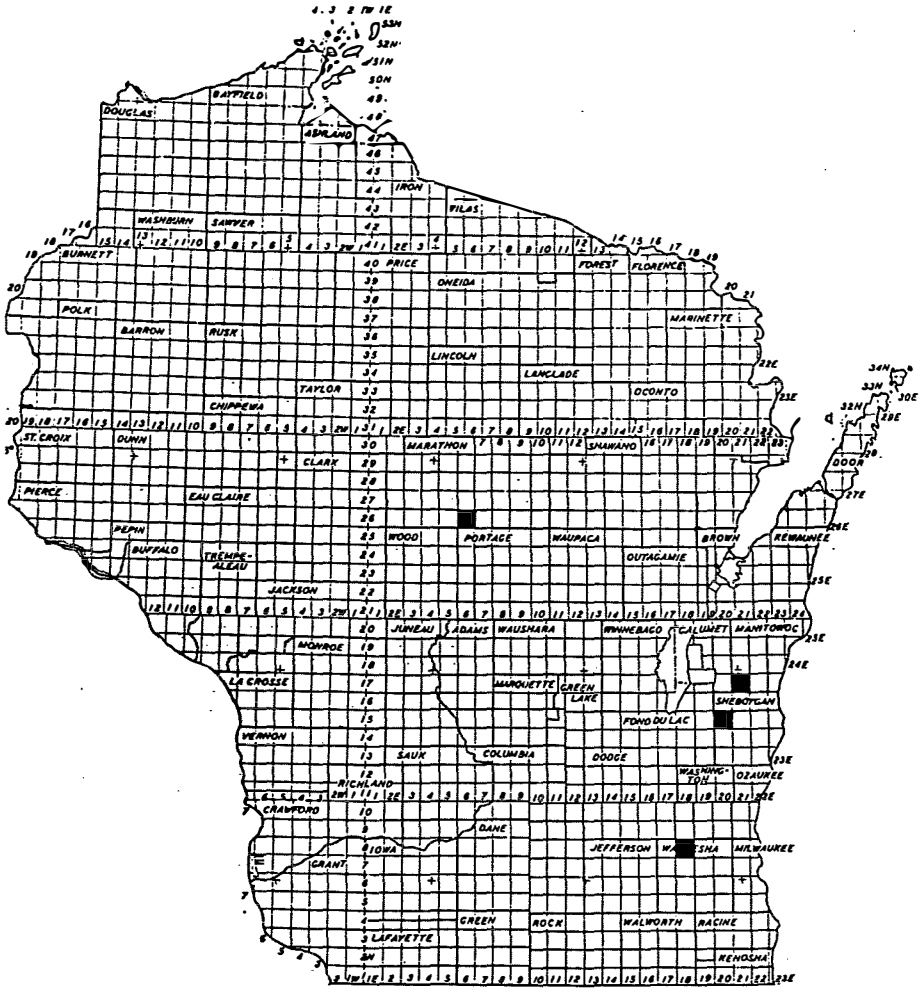


Figure 2. Known township locations of Ash Yellows in Wisconsin-1991.

ASPEN

Aspen Bronzing
- Unknown

Twig and branch dieback and foliage discoloration were observed on trees in previously identified locations in northwestern Wisconsin. One new location of aspen bronzing was observed in Sawyer County, Town of Edgewater, NE¼, NE¼, Section 33, T37N, R9W. The known township locations of aspen bronzing are shown in Figure 3.

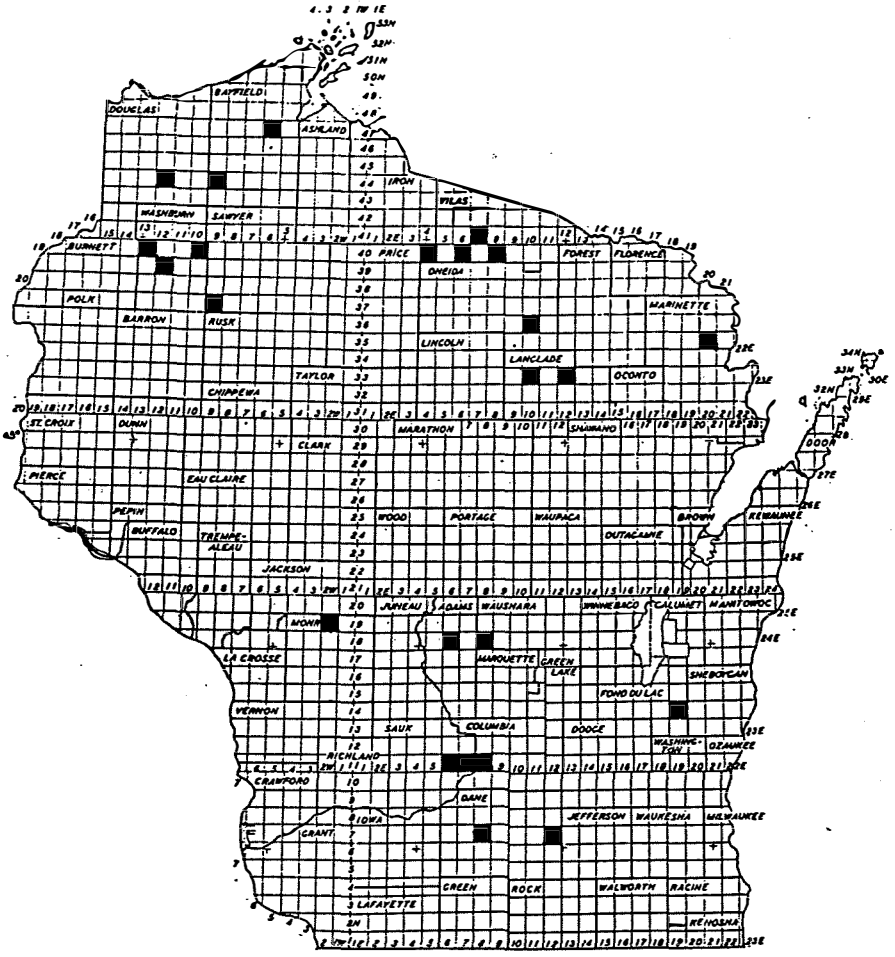


Figure 3. Known township locations of Aspen Bronzing - 1991.

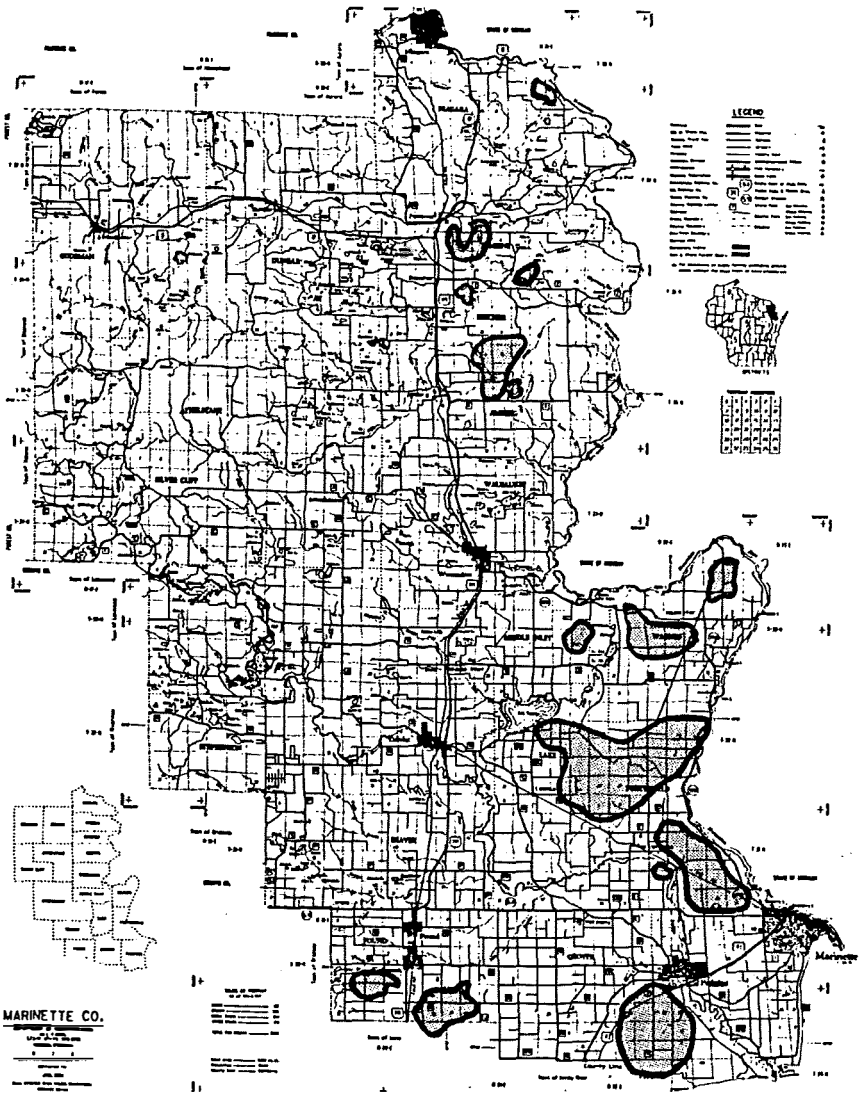


Figure 4. Areas of light to heavy defoliation by the Forest Tent Caterpillar - 1991.

Forest Tent Caterpillar - *Malacosoma disstria* (Hubner)

The widespread outbreak that has plagued northern Wisconsin since 1986 declined significantly in area and intensity. In northwestern Wisconsin, a complete collapse of the insect population occurred and no defoliation was observed. Pockets of heavy defoliation occurred in Marinette, Oconto and Menominee counties and pockets of light to moderate defoliation occurred in Door, Brown, Kewaunee and Manitowoc counties (Figure 4).

Phenological Notes:

April 28 — Larvae hatching in Shawano County.
May 22 — Larvae active in Brown County.
June 5 — Larvae in last instar in Menominee, Marinette, Oconto, Door, Brown, Kewaunee and Manitowoc counties.

Large Aspen Tortrix - *Choristoneura conflictana* (Walker)

Scattered spots of moderate defoliation were observed in southern Sawyer and northern Rusk counties.

BALSAM FIR

Spruce Budworm - *Choristoneura fumiferana* (Clemens)

Populations remained very low in northwestern Wisconsin. Only one egg mass was observed during the egg mass survey.

Balsam Gall Midge - *Paradiplosis tumifex* (Gagne)

In northwestern Wisconsin, populations were low. Galls were observed, but were scattered and infrequent. In northcentral Wisconsin, a heavy infestation was reported in Balsam fir Christmas trees in Lincoln County.

Balsam Twig Aphid - *Mindarus abietinus* (Koch)

This insect was observed in scattered locations statewide but did not cause significant injury to balsam. Ladybugs were observed feeding on the aphids.

Balsam Shootboring Sawfly - *Pleroneura brunneicornis* Rohwer

Heavy damage to balsam fir Christmas trees was observed in Langlade County.

BASSWOOD

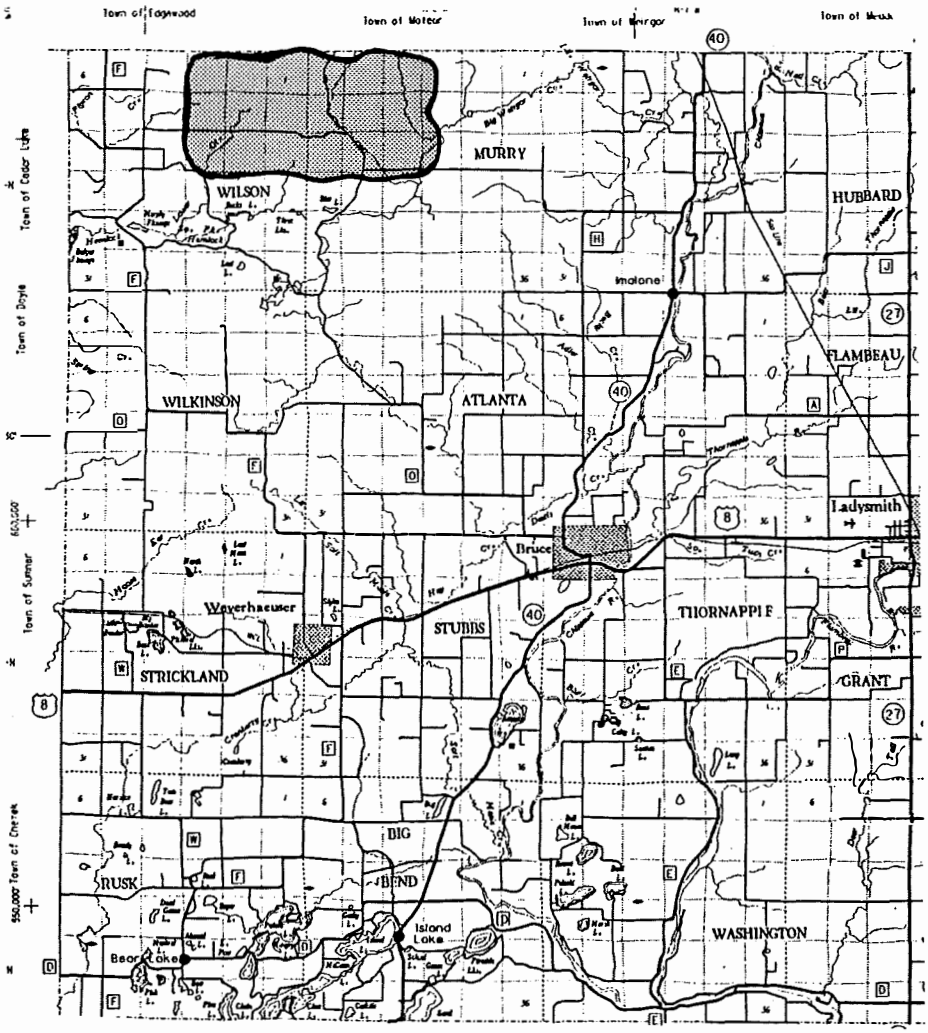


Figure 5. Area of defoliation by the Basswood Thrips - 1991.

Introduced Basswood Thrips - *Thrips calcaratus* Uzel

Damage to basswood foliage was very low statewide. Even light defoliation was rare in northern Wisconsin where heavy defoliation has been common in most years. Very light defoliation was observed over 15,000 acres in Rusk County, Sections 4-9 and 16-18, T36N, R8W, and Sections 1-3 and 10-15, T36N, R9W, on the northern flank of the Blue Hills (Figure 5). Very light defoliation of basswood occurred on some of the North American Sugar Maple survey plots in Bayfield, Sawyer, Ashland, Iron, Langlade, Oconto and Marinette counties (Figure 8).

BIRCH

Birch Leafminer - *Fenusa pusilla* (Lepeletier)

Symptoms were widespread, but the incidence of this insect appeared to decrease from 1990 levels. Typical spring browning of birch crowns occurred on open grown trees in Washburn, Douglas, Bayfield, Sawyer, Langlade, Oneida and Vilas counties.

Bronze Birch Borer - *Agrilus anxius* Gory

The populations of the bronze birch borer declined as most drought-damaged birch were already dead and rainfall helped relieve the drought stress on remaining birch. Birch mortality also declined dramatically with the onset of normal rainfall. Both recovery and continued decline was noted in Langlade, Lincoln, Oneida, Forest, Oconto, Marinette and Vilas counties.

Yellow Birch Dieback - Unknown

There was no progression in previously reported dieback of yellow birch in northwestern Wisconsin. Yellow birch dieback was first reported on the Flambeau River State Forest in northwestern Wisconsin in 1985.

BUTTERNUT

Butternut Canker - *Sirrococcus clavigignenti - juglandacearum* Nair, Kostichka and Kuntz

No new locations of butternut canker were observed in 1991 (Figure 6). A statewide survey of butternut to determine the distribution and severity of this disease is planned for 1992.

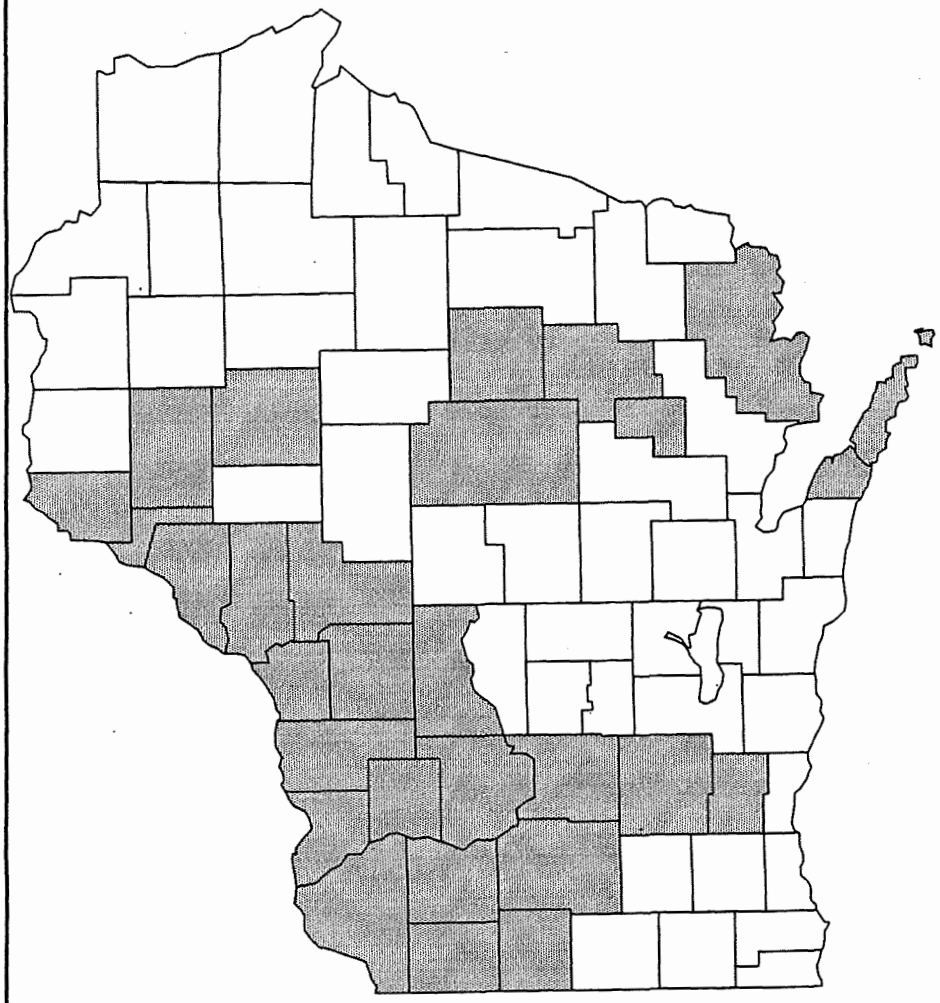


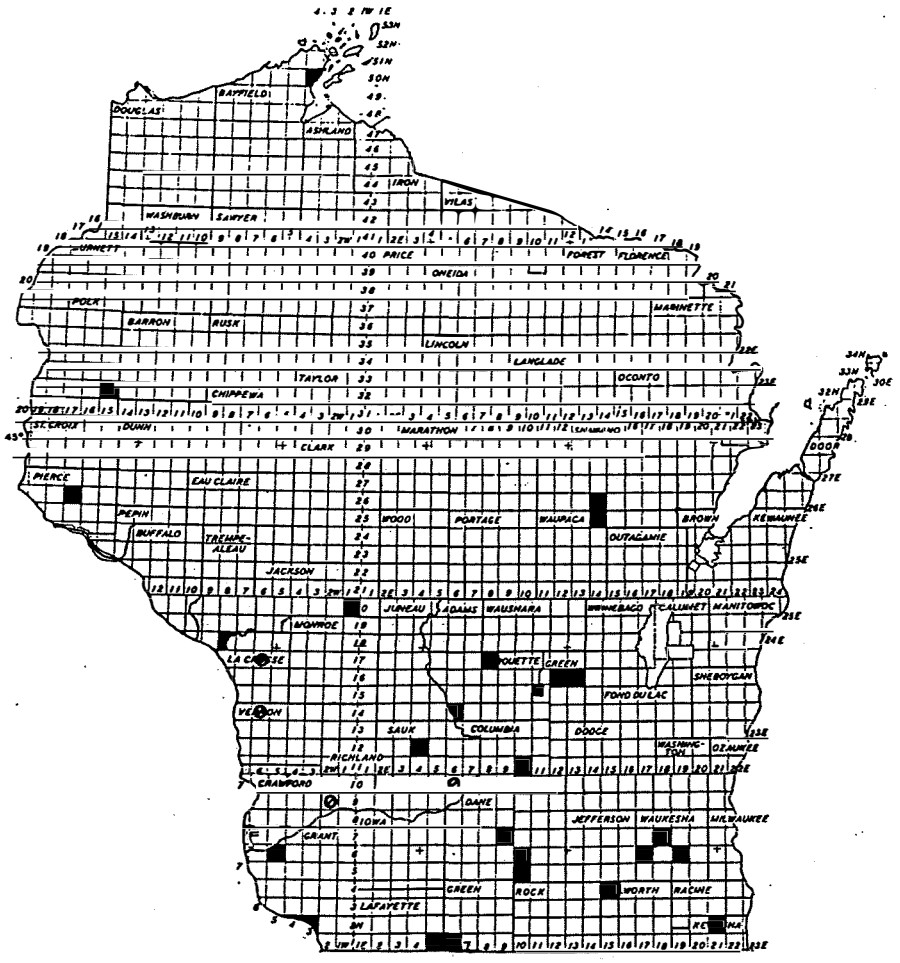
Figure 6. Known county distribution of Butternut Canker - 1991.

CHERRY

Eastern Tent Caterpillar - *Malacosoma americanum* (Fabricius)

Populations declined in most of Wisconsin from 1990 levels. Tents were rare and scattered over most of the state except in the southeastern counties where it was relatively high.

CHESTNUT



Chestnut Locations = ■ Chestnut Blight Locations = ⊘

Figure 7. Township locations of Chestnut and Chestnut Blight - 1991.

Chestnut Blight - *Endothia parasitica* (Murrill) Anderson and Anderson

There was no change in the statewide distribution of chestnut blight in 1991 (Figure 7). Survey efforts for this disease were concentrated on the 60-acre American chestnut stand in LaCrosse County where a total of 24 American chestnuts are now infected with the disease. Fifty-four cankers are present on the 24 trees. A 1990 survey revealed a total of 2,434 American chestnut trees >2" in diameter are present on the property. Efforts to introduce the hypovirulent form of the fungus were postponed until 1992 because of difficulties in converting the virulent isolate to hypovirulent.

In Richland County where chestnut blight was first observed in Wisconsin, a 10-acre stand of chestnuts was resurveyed to determine disease incidence. In 1989, 18 of 32 trees were infected. In 1991, 30 of 32 trees were infected.

CHRISTMAS TREES

Cyclaneusma Needlecast - *Cyclaneusma minus* (Butin) DiCosmo, Peredo and Minter

A survey for Cyclaneusma needlecast was conducted in 10 Scotch pine Christmas tree plantations as part of an Integrated Pest Management (IPM) Program cooperatively run by the University of Wisconsin-Extension-IPM, and the Wisconsin DNR. Four trees per acre on 83 acres were sampled. Five, 1990, and 5, 1991 needles were isolated per sample onto Potato Dextrose Agar. A total of 334 trees were sampled. Seventy-two percent of the trees sampled had Cyclaneusma present. Seventy-two percent of the trees had 1990 needles that were infected and 30% of the trees had 1991 needles infected. A fall survey was conducted at the peak of needlefall and discoloration to determine whether or not the presence of needlecast was causing the trees to be unmarketable.

The following recommendations were developed:

1) Many growers do not have to spray for Cyclaneusma even if they have infected trees. Many of the infected trees had enough growth to mask the needlecast. Growers were advised to watch their trees each year, and as long as they are marketable, there is no need to spray.

2) Growers who wanted to enter into a spray program could conduct a "partial" program where they spray the trees that are within 2 years of going to market. Growers choosing this option would spray April through October every 6 to 8 weeks one year before selling and in April and June the year of marketing. Any products containing chlorothalonil were recommended.

3) Growers who wanted to enter into a "complete" spray program would spray all trees every year. This was not recommended unless growers had a history of widespread heavy needlecast throughout their age classes.

Winter Injury

Wisconsin had very cold temperatures (close to 0°F) the week of November 4, 1991. The cold temperatures froze the ground quite solid. During the week of November 11, there were warm days with sunshine and warm winds. On November 16, several growers noticed Scotch pine and white spruce changing color. The current year's growth on the Scotch pine turned yellow, then brown, and the white spruce's current year's growth turned purple. The spruce rapidly lost their 1991 needles. The cold weather which froze the ground, followed by warm temperatures, sunshine, and warm winds, probably caused the trees to transpire when the water could not be replaced from the frozen ground. Discoloration of Scotch pine and white spruce was widespread in southern and central Wisconsin. Most of the trees examined still had green buds and twigs. The injured trees are expected to loose their discolored needles in the spring. If good snow cover occurs and the wide temperature fluctuations do not occur again before spring, the injured trees should bud out and continue to grow.

Balsam Fir - Fern Rust - *Uredinopsis americana* P. Syd. & Syd.

Scattered balsam fir Christmas trees on low wet sites in Oneida and Langlade counties lost up to 25% of their current year's needles on scattered branches.

Spruce Needle Rust - *Chrysomyxa* sp.

Moderate to heavy needle loss was observed on Colorado blue spruce and occasionally white spruce in Oneida, Vilas, Saywer, and Price counties.

LARCH

Larch Needlecast - *Mycosphaerella laricina* (Hartig) Neg.

This disease was severe on a 10-acre planting of European larch in Lorain Township, Polk County (Section 32, T37N, R15W). Affected trees were bright orange in mid-August from needle discoloration, and were completely defoliated by mid-September.

Larch Sawfly - *Pristiphora erichsonii* (Hartig)

Populations increased in the northeastern counties. Small stands of scattered larch were heavily defoliated in Langlade, Oneida and Vilas counties. In northwestern counties, populations decreased and defoliation was uncommon.

MAPLE

Sugar Maple Decline Survey - North American Maple Decline Project

Wisconsin continued to participate in the North American Maple Project, administered by the U.S. Forest Service and Canadian Forestry Service. Eighteen plots were established in Wisconsin in 1988, 9 in stands being tapped for maple syrup and 9 in forest stands not tapped for maple syrup (Figure 8).

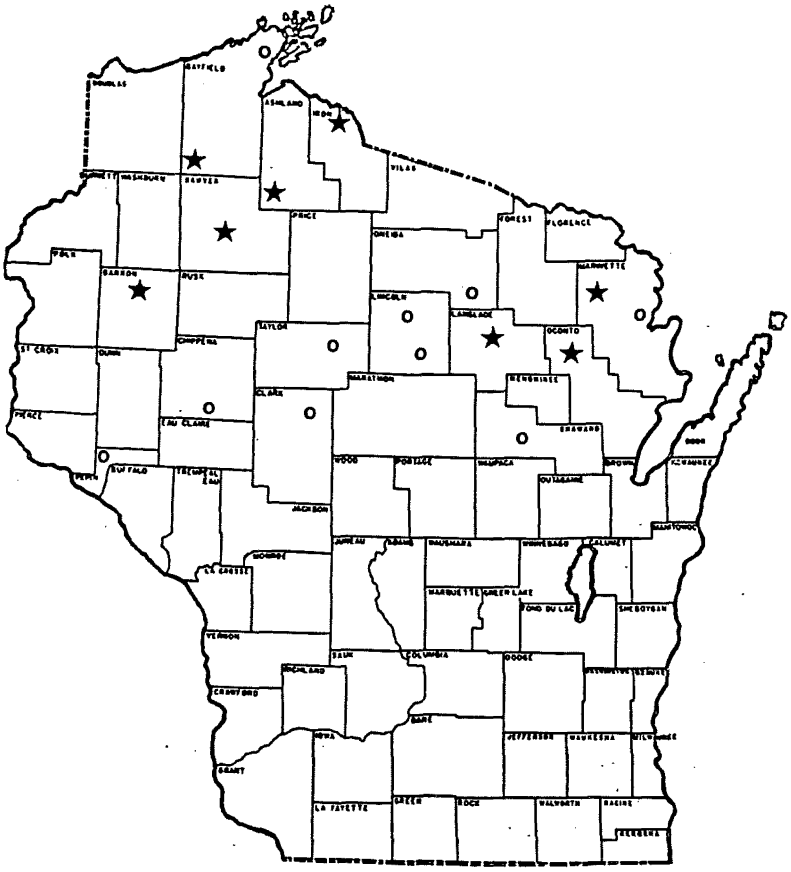


Figure 8. Location of plots in North American Sugar Maple Decline Project.

Plots with defoliation of basswood by basswood thrips = ★
Plots without defoliation of basswood = o

Data were collected on the plots in 1988, '89, '90, and '91 to monitor vigor, dieback, discoloration, dwarfing, and crown transparency. Data will be collected in 1992 and eventually published in a joint USDA Forest Service and Canadian Forestry Service Report.

Saddled Prominent - *Heterocampa guttivitta* (Walker)

Heavy, late-season defoliation of sugar maple occurred in and around Peninsula State Park in Door County.

MISCELLANEOUS SPECIES

Gypsy Moth - *Lymantria dispar* (L.)

A spotty, very light infestation exists along the Lake Michigan shoreline in Kewaunee, Manitowoc, Sheboygan and Ozaukee counties; the infestation extends inland into Door and southern Marinette counties. Proof of the infestation was revealed by the presence of female moths, larvae, pupae, cast skins and egg masses in these areas. Trap catches occurred over a much larger area. Although the total numbers of male moths caught in pheromone traps decreased from 1990 levels, the trap catches revealed concentrations that probably represent infestation centers in Oconto and Brown counties.

DNR continued to cooperate with Wisconsin Department of Agriculture (WDATCP), Trade and Consumer Protection, USDA Forest Service, USDA APHIS, and University of Wisconsin - Extension in a program to eradicate the infestation. Five locations in Door and Kewaunee counties totaling 5,875 acres were sprayed twice with undiluted applications of the bacterial insecticide, *Bacillus thuringiensis* at a rate of 20 BIU.

Spot infestations associated with infested nursery stock are also known to occur in Dane and Jefferson counties.

The table below lists the 1991 trap catches. The information was provided by WDATCP and is up to date as of November 19, 1991. Counties where gypsy moth egg masses, females, pupae, larvae or larval skins were found are denoted by **.

County	Adult Males	County	Adult Males
Ashland	2	Oconto	308
Brown	435	Outagamie	60
Calumet	43	Ozaukee	333**
Dane	32**	Polk	0
Dodge	22	Portage	0
Door	2668	Racine	370
Florence	1	Rock	0
Fond du Lac	49	Sawyer	1
Forest	0	St. Croix	2
Jefferson	46**	Shawano	28
Kewaunee	133	Sheboygan	1745**
Kenosha	1953**	Washington	64
Langlade	0	Walworth	0
Manitowoc	1835**	Waukesha	107
Marinette	428**	Waupaca	16
Menominee	7	Winnebago	60
Milwaukee	536	Wood	0
		State Total	11,284

Periodical Cicada - *Magicada septendecim* (L.)

The effects of the 1990 adult emergence are fading quickly. Heavy 1990 oviposition damage to a young black walnut plantation was difficult to find by mid summer of 1991.

Giant Elm Sawfly - *Cimbex americana* Leach

This large late-season sawfly caused heavy defoliation to ornamental willows in Shawano and Taylor counties.

NURSERY

White Pine Seedling Root Rot - *Fusarium* sp.

The U.S. Forest Service, North Central Forest Experiment Station continued to conduct research on the cause of white pine root rot at the Wilson state forest tree nursery near Boscobel in southwestern Wisconsin. The objectives of the study were to determine the cause of white pine root rot and determine the relationship between soil moisture potential and disease incidence. Koch's postulates are being conducted with isolates collected during the 1991 field season and plans are to continue studying the relationship between soil moisture potential and disease incidence in 1992.

White pine root rot was common and widespread at the Hayward state forest tree nursery. The cause of this root rot has not been determined, although a *Fusarium* sp. is suspected.

Diplodia Shoot Blight and Canker - *Sphaeropsis sapinea* (Fr.) Dyke and Sutton

See Appendix A for detailed report.

Red Pine Heat Injury

Small (2-3mm in height) vertical lesions were observed just above the soil line on 1-0 red pine seedlings at the Wilson state forest tree nursery in Boscobel, Wisconsin. The lesions were first observed in mid-August. Heat injury is the suspected cause of the lesions. Scattered light mortality was observed.

OAK

Walkingstick - *Diapheromera femorata* (Say)

After several years of very low populations this late season defolator has increased in numbers to cause heavy defoliation of northern pin oak in southern Marinette and northern Oconto counties.

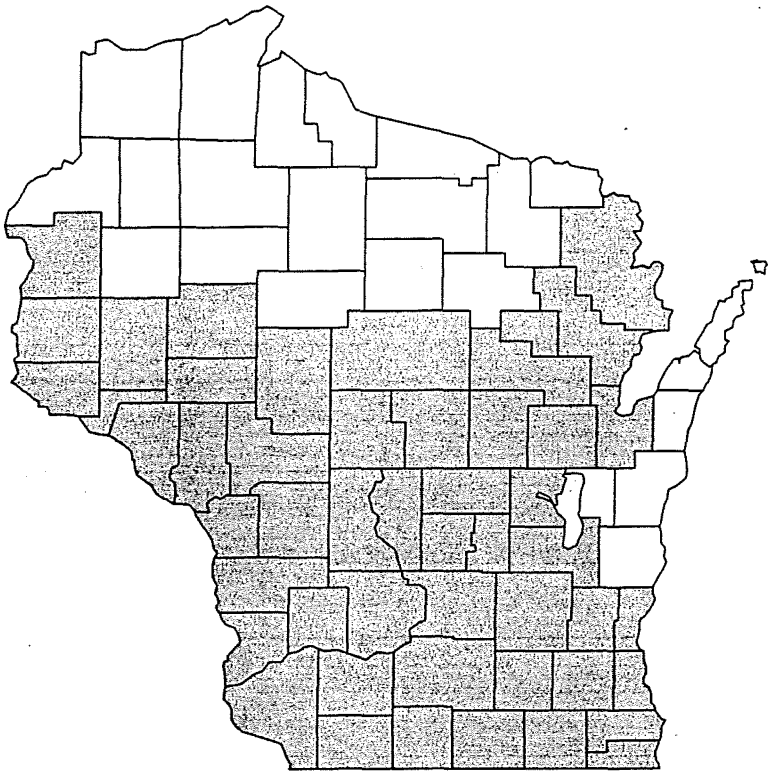


Figure 9. Known county distribution of Oak Wilt - 1991.

Oak Wilt - *Ceratocystis fagacearum* (Bretz) Hunt

There was no change in the statewide distribution of oak wilt (Figure 9). Mortality from two-lined chestnut borer continued to make oak wilt surveys difficult in Marinette County, northeastern Wisconsin. Good moisture in 1991 has slowed the two-lined chestnut borer infestation, and surveys for oak wilt in 1992.

Around Legend Lake, in Menominee County, northeastern Wisconsin, 22 samples were taken from areas of dying oak. Four samples were positive for oak wilt. These pockets will be trenched to break the root grafts between healthy and diseased trees and the infected trees will be removed as part of an intensive oak wilt control program by the Legend Lake Property Owners Association.

Two-lined Chestnut Borer - *Agrilus bilineatus* (Weber)

Late summer mortality declined dramatically over most of Wisconsin with the cessation of the drought. Light mortality continued in the northwestern counties of Burnette and Douglas. Scrub oak continued to die in Marinette and Oconto counties in northeastern Wisconsin following spring defoliation by the forest tent caterpillar. In these counties, the accumulated mortality induced by several years of defoliation has left many oak stand severely depleted.

Oak Lacebug - *Corythucha arcuata*

These dainty delicate living doilies damaged oak trees on over 100,000 acres in Sawyer, Washburn, Burnett and Douglas counties. Most feeding was on bur oaks. Infested leaves changed from dark green to dull bronze.

Leaf-mining Maggot - *Japanagromyza viridula* (Coqillett)

Noticeable leaf damage of red oak caused by this leaf-mining maggot was widespread in southern Wisconsin. Typical spring adult oviposition damage and larval feeding injury (small irregularly shaped holes) were observed in Lafayette, Milwaukee, Washington, Waukesha, Racine, Walworth, Sheboygan and Fond du Lac counties.

PINE

Diplodia Canker and Shoot Blight - *Sphaeropsis sapinea* (Fr.) Dyke and Sutton

New locations of *Diplodia* were observed in Douglas County Forest (T43N, R10W, Section 2) and Washburn County Forest (T40N, R11W, Section 30). Disease incidence in previously observed infections in northwest Wisconsin increased slightly.

In Dunn County, western Wisconsin, scattered branch infections were observed on red pine in an area damaged by a hail storm in 1988.

Diplodia shoot blight and canker have been present for several years in Douglas County, northwestern Wisconsin. A 20-acre red pine plantation on county forest land (T43N, R13W, Section 31, SWSW) was heavily infected in 1989. A cooperative survey project between the U.S. Forest Service and DNR forest pest management to determine disease incidence and within tree disease development was initiated. In November 1989, approximately 60% of the trees surveyed were diseased. In November 1990, 100 trees were evaluated for disease development. Twelve percent of the trees had no change in the number of infected branches. Eighty-eight percent had some disease development as evidenced by an increase in the number of infected branches or mortality of the tree.

Scleroderris Canker - *Ascocalyx abietina* (Naumov) (Schlaep fer-Bernhard)

No new county locations were reported in 1990 (Figure 10). No major increase in new infections were observed in previously reported counties.

Figure 10. Known county distribution of Scleroderris canker - 1991.

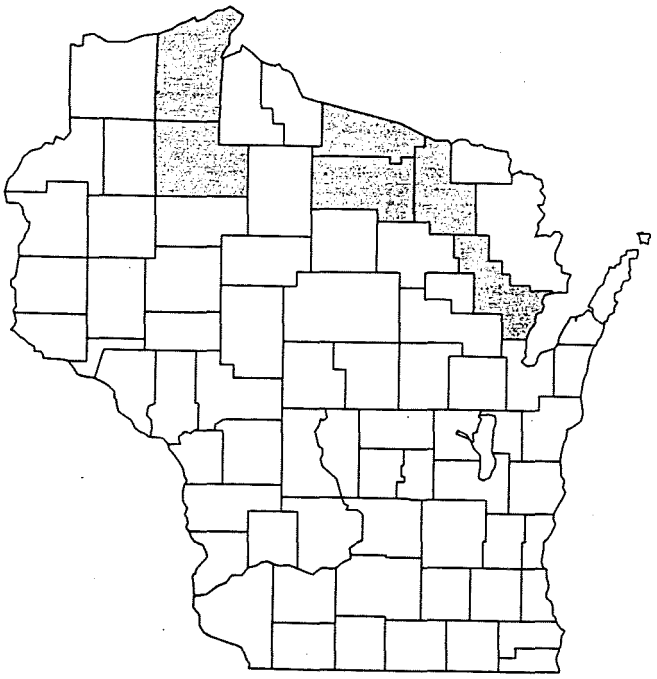


Figure 11. Known county distribution of *Sirococcus conigenus* - 1991.

Red Pine Shoot Blight - *Sirococcus conigenus* (D C.) P. Cannon & Minter

No new locations of red pine infected with Sirococcus shoot blight were observed (Figure 11).

Pine Tussock Moth - *Dasychira pinicola* (Dyar)

This early season defoliator of jack pine appears to be on the rise in its hazard area in central and eastern Douglas county where egg masses were easy to find. The last outbreak began its rise in 1980 in the same area.

Jack Pine Budworm - *Choristoneura pinus* (Rohwer)

A ten fold increase in larval numbers may indicate the beginning of a full scale outbreak in Douglas and Bayfield Counties. A survey revealed very light larval parasitism. Defoliation was very light but visible in southern Douglas County.

European Pine Sawfly - *Neodiprion sertifer* (Geoffroy)

The outbreak continued for the second year in southern Wisconsin. Pockets of heavy defoliation occurred in Dane, Rock, Green, Lafayette and Iowa counties. In Iowa County, colonies of this species were observed on the same branch of a scotch pine sapling with the red pine sawfly. Large numbers of the parasitic wasp, *Dibrachys cavus* (Walker) were reared from cocoons from Walworth County.

Red Pine Sawfly - *Neodiprion nanulus nanulus* Schedl

Pockets of light to heavy defoliation of red and jack pine occurred from northern to southern Wisconsin. Spotty light defoliation of red pine occurred in Iowa and Columbia counties. Heavy defoliation of jack pine occurred on 10,000 acres in Burnett County and 5,000 acres in Douglas county.

Jack pine Sawfly - *Neodiprion pratti banksianae* Rohwer

Populations arose to their highest levels in memory throughout northwestern Wisconsin. Extremely heavy defoliation occurred in central Douglas and western Burnett counties where some where some mature jack pines were completley stripped of old foliage.

Redheaded Pine Sawfly - *Neodiprion lecontei* (Fitch)

Populations continued at very low levels with only slight defoliation to volunteer jack pine in the northwestern counties.

Redheaded Jack Pine Sawfly - *Neodiprion rugifrons* Middleton

This jack pine defoliator went unnoticed during the spring generation and exploded in September to completely defoliate 715 acres of all-aged jack pine in east central Juneau County (Figure 12). This area was surrounded by several thousand acres of diffuse, light defoliation.

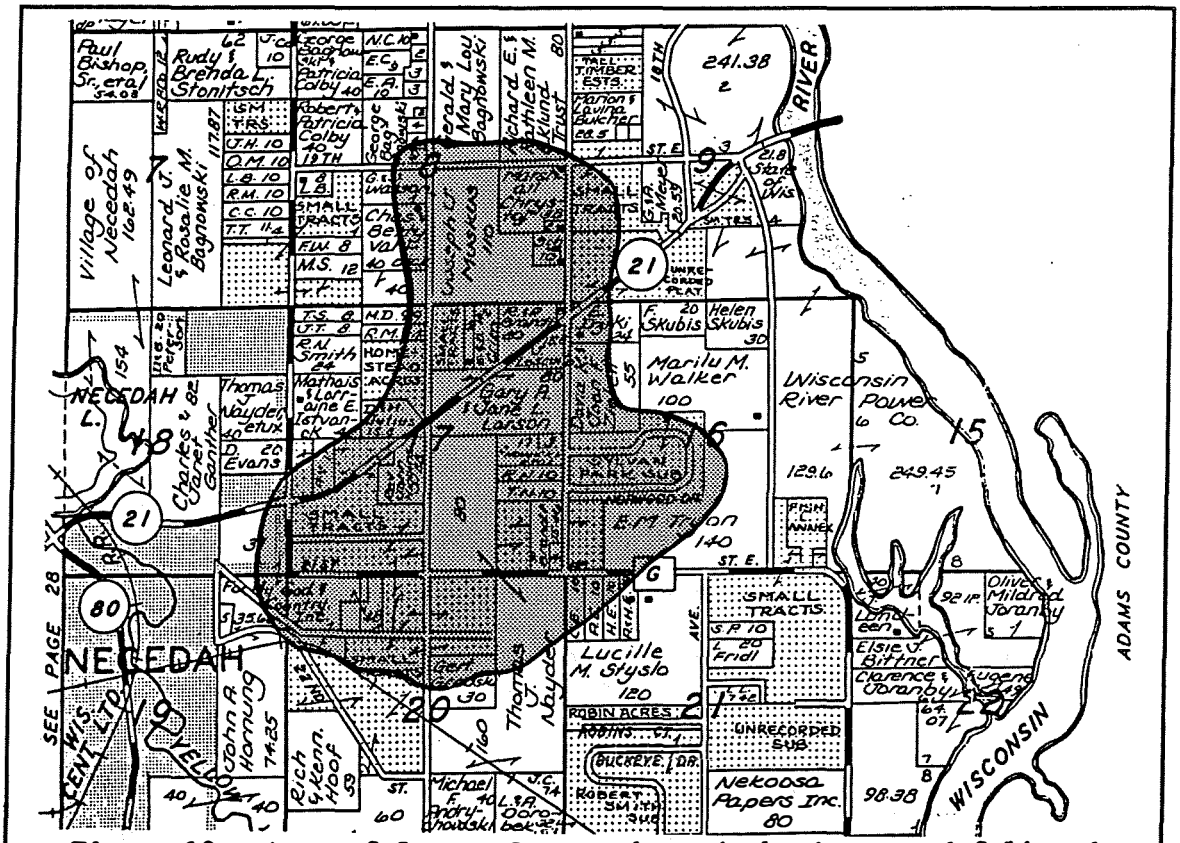


Figure 12. Area of Juneau County where jack pine was defoliated by the redheaded jack pine sawfly - 1991.

White Pine sawfly - *Neodiprion pinetum* (Norton)

Populations were very low statewide. Only a single report of defoliation by this sawfly was received from Rusk County.

Introduced Pine Sawfly - *Diprion similis* (Hartig)

Populations exploded in the northern third of Wisconsin to cause light to heavy defoliation of white pine. Generally, large open-grown trees received the heaviest defoliation. Occasional pockets of heavy defoliation of all aged white pine were observed. There were large pockets of severe defoliation of white pine in Sawyer County.

Pine Webworm - *Tetralopha robustella* Zeller

Scattered pockets of heavy defoliation occurred in a four-year-old red pine seed orchard in Adams County.

Red Pine Needle Midge - *Thecodiplosis piniresinosae* Kearby

This late-season needle-damaging midge caused light browning on about 30,000 acres of red pine plantations in central Burnett County. There were no reports of damage elsewhere.

Red Pine Shoot Moth - *Dioryctria resinosella* Mutuura

Numbers of attacked shoots remained very high in red pine windbreaks, edge trees and other open-grown trees in Adams and Waupaca counties and along the Lower Wisconsin River in Sauk, Iowa and Grant counties.

The first significant incidence in 10 years occurred in the northwestern counties. Edge trees were noticeably attacked in Rusk and Barron counties. Minor attack occurred in Washburn and Burnett counties.

Eastern Pine Shoot Borer - *Eucosma gloriola* Heinrich

Damage to pines was noticeable in most of Wisconsin. In northwestern Wisconsin, jack pine suffered extensive damage to terminal shoots and red pine shoots were attacked locally. In central and southern Wisconsin, Scotch pine Christmas tree suffered light to moderate damage.

Saratoga Spittlebug - *Aphrophora saratogensis* (Fitch)

Populations remained very low throughout Wisconsin; no damaging populations were observed or reported.

Pine Tortoise Scale - *Toumeyella parvicornis* (Cockerell)

A heavy infestation on scattered, open-grown jack pine in Langlade County produced heavy sooty mold on the needles and branches.

Pine Root Collar Weevil - *Hylobius radicis* (Buchanan)

Damage to Scotch pine Christmas trees in the central counties continued at the normal low levels. Damage usually does not appear until the trees are 3 feet tall after which mortality is normally around 0-5% in untreated plantings. In northwestern Wisconsin, injury continues to be light and symptoms rare.

Pine Root Tip Weevil - *Hylobius rhizophagus* Millers, Benjamin and Warner

Very little damage was reported in Wisconsin this year. An increase in symptoms was noted in western Washburn County.

White Pine Weevil - *Pissodes strobi* (Peck)

Moderate to high populations were observed in northwestern Wisconsin. Christmas tree growers in Burnette and Polk counties observed symptoms on their white pine Christmas trees. Moderate damage to white pine Christmas trees was reported in Portage county.

Pine Engraver - *Ips pini* (Say)

Pine mortality was generally low throughout Wisconsin with fewer than the normal number of pockets of trees killed. Despite massive amounts of pine slash and severely damaged pine created by a March 22 and 23 ice storm in Bayfield County, bark beetle damage stayed very low due to extremely wet conditions in the northwestern counties.

White Grubs - *Phyllophaga* sp.

Damage to new conifer plantings was generally low. Heavy damage to new red and white pine plantings was reported in Kewaunee and Manitowoc counties.

Plains Pocket Gopher - *Geomys bursarius*

Very heavy damage to young red pine plantations occurred in St. Croix County. A 60-acre, two-year old red pine planting suffered nearly total mortality. A 15-acre, five-year-old planting has suffered more then 50% mortality.

SPRUCE

Yellowheaded Spruce Sawfly: *Pikonema alaskensis* (Rohwer)

A Washburn County population that had been heavy in 1990, collapsed in 1991. Elsewhere in the northwestern counties populations on open-grown white spruce were generally moderate.

Populations increased somewhat in the northeastern counties where pockets of moderate to complete defoliation of ornamental white and blue spruce occurred in Langlade, Oneida, Forest and Vilas counties.

Spruce Needle Rust: *Chrysomyxa* sp.

Moderate to heavy needle loss was observed on Colorado blue spruce and occasionally white spruce in Oneida, Vilas, Saywer, and Price counties.

WEATHER

Storm Damage - Bayfield County

On March 22, 1991, rain, ice, and heavy wet snow caused injury to white birch, aspen, jack and red pine in Bayfield County. The ice and snow weighed down the tree tops and caused stem and branch breakage. On the Chequamegon National Forest, approximately 50,000 cords of harvest were planned to salvage the damaged timber. The most severe injury occurred in Sections 1, 2, 11, 14, 22, 23, 26, and 27 of T48N, R6W; Sections 26, 33, 35, and 36 of T48N, R7W; and Sections 2-5, 8-11, 15, and 16 of T47N, R7W. Management of the storm damaged areas on the Chequamegon ranged from clearcut and natural regeneration of jack pine (50% of acres), clearcut and plant red pine (23% of acres), partial cuts (16% of acres), and let rot (11% of acres).

Storm Damage - Chippewa and Rusk Counties

On May 29, 1991, a windstorm swept through southern Rusk County (Figure 13) and northern Chippewa County (Figure 14). The storm included series of downbursts than caused windthrow on millions of trees. Saturated soils and heavy foliage facilitated the windthrow. On dryer soils, stem breakage was more common than uprooting. In Chippewa County, approximately 21,525 acres of woodland on private and public lands and 3,025 acres of county forest lands were affected. Losses were highest in oak, aspen, and other hardwoods; approximately 76,286 cords and 5,182,380 board feet of hardwoods were affected by the storm. Approximately 4,239 cords and 179,200 board feet of pine, spruce, fir, tamarack and cedar were affected by the storm.

Drought -

Drought-induced birch mortality slowed considerably in northern Wisconsin due to the return of ample rainfall in the last two growing seasons. Oak mortality associated with two-lined chestnut borer, was reduced to very minor levels in northwestern Wisconsin.

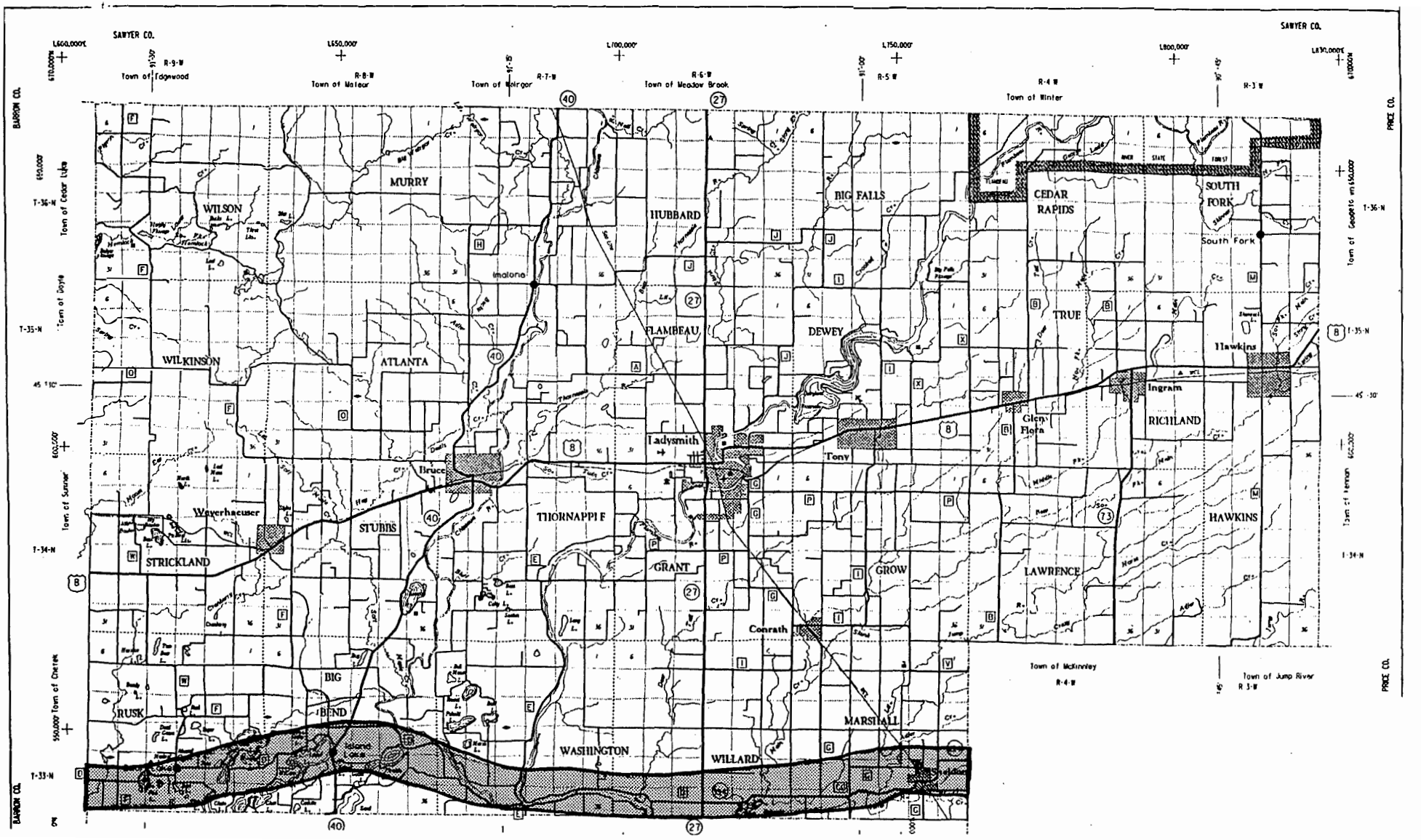


Figure 13. Area of known forest tree injury by May 29, 1991 wind storm - Rusk County.

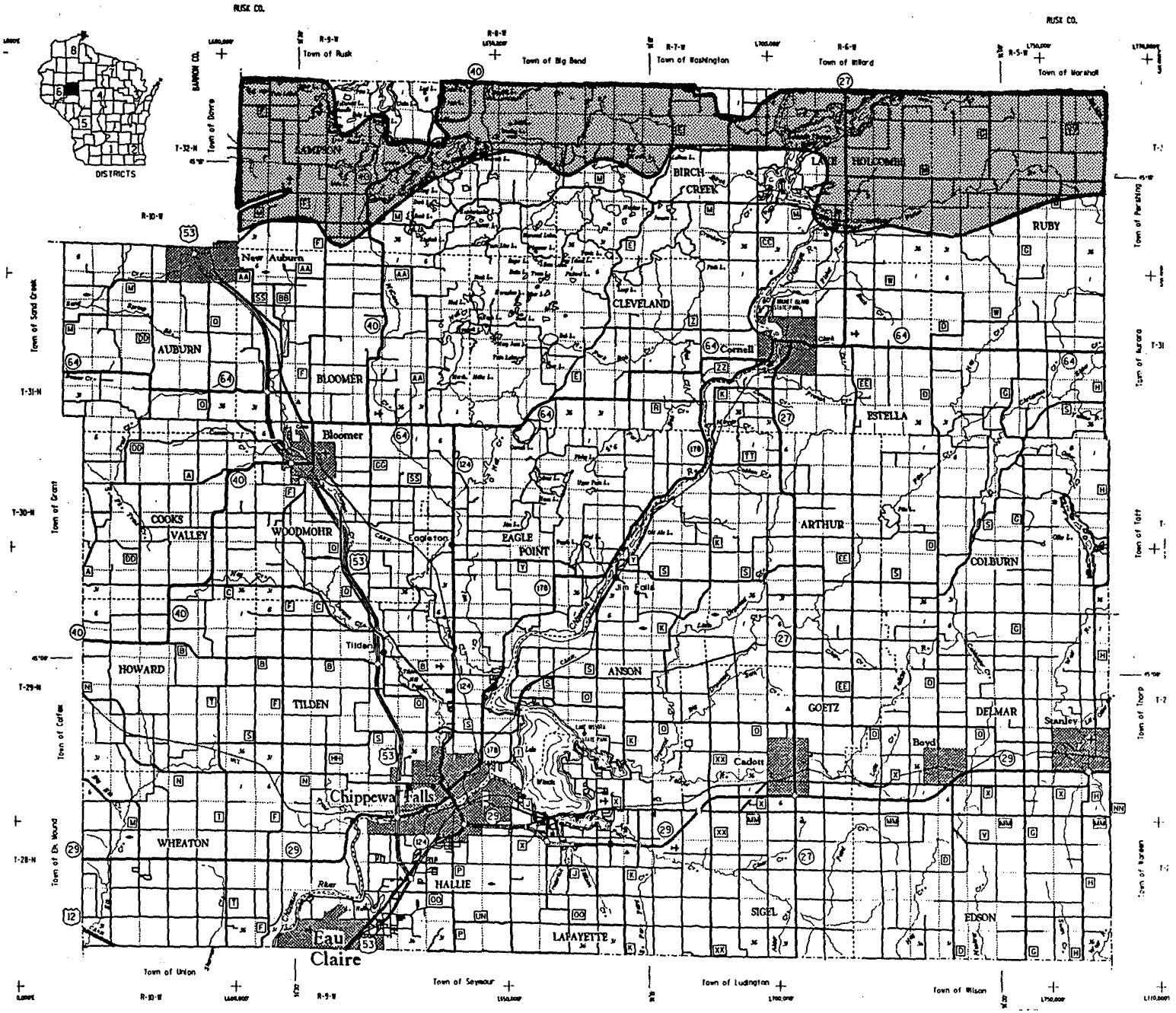


Figure 14. Area of known forest tree injury by May 29, 1991 wind storm - Chippewa County.

APPENDIX A

Diplodia Shoot Blight and Canker at Wilson Nursery

by

Jane Cummings Carlson and Lynn Hummel[1]

Diplodia Shoot Blight and Canker caused by *Sphaeropsis sapinea* (Fr.) Dyke and Sutton

Diplodia shoot blight and canker has been a major pest of red pine at the Wilson state nursery in Boscobel, southwestern Wisconsin, since the early 1980s. Preventative treatment with the fungicide Benomyl has been effective in controlling Diplodia. An integrated pest management program including removal of infested windbreaks and a decrease in the use of Benomyl was initiated in 1990. Disease incidence of treated (Benomyl sprays) and untreated red pine seedlings has been monitored for two years in areas scattered throughout the nursery. The trees under observation were located in areas of the nursery where disease was expected to be the highest because of their proximity to the few remaining infected windbreak trees.

Benomyl treatments were applied to 4′ x 12′ plots. Seedlings in their first growing season were treated with 1 lb product (Benomyl 50W) per acre every other week, early June through August. Seedlings in their second growing season were treated every other week, late April through May. Plots in Section A in the northeast end of the nursery were sprayed in 1990 and 1991. Plots in Section C in the west-central portion of the nursery were sprayed in 1990.

In Section A, disease incidence was monitored in September of 1990 and 1991 in 22 plots, 10 sprayed and 11 unsprayed. One sprayed plot had complete mortality from wind-blown sand damage resulting from removal of the windbreaks. In 1990, disease incidence in the unsprayed plots averaged 2.4% and ranged from .8 to 8%. Disease incidence in the sprayed plots averaged .6% and ranged from 0 to 1.6%. Even though disease incidence was higher in the unsprayed plots, the average was still very low (2.4%). In 1991, (during the second year of growth) disease incidence decreased or remained the same in 7 of 11 unsprayed plots and in 8 of 9 sprayed plots (Table 1). These results support the research findings that predict disease incidence to be highest in red pine during the first growing season. Disease incidence may have remained low due to less than perfect conditions for Diplodia infection.

In Section C, disease incidence was monitored in September of 1991 in 16 unsprayed and 16 sprayed plots. Disease incidence averaged 1.5 and .4% in the unsprayed and sprayed plots respectively (Table 2). Throughout this project, disease incidence has almost always been lower in the sprayed plots yet disease incidence is still very low in the unsprayed plots and may be low enough to stop fungicide sprays.

This project is continuing in 1992 where plots in Section C will be monitored for another year and new plots have been established in the east end of the nursery.

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[1]Forest Pathologist and Nursery Superintendant, Wisconsin Department of Natural Resources.

TABLE 1. Incidence of Diplodia shoot blight in bed rows treated with Benlate fungicide and untreated bed rows - Section A, Wilson Nursery.

UNSPRAYED			SPRAYED 1990 & 1991		
Location[1]	Disease Incidence[2] 1990[3]	1991[4]	Location	Disease 1990	Incidence 1991
			A-5 Row 1	1.6	0.0
A-3 Row 8	8.0	4.3	A-5 Row 2	1.5	1.0
A-5 Row 7	.9	1.1	A-6 Row 1	0.0	1.5
A-5 Row 7	3.0	1.9	A-6 Row 2	.6	0.0
A-6 Row 7	.8	1.8	A-7 Row 1	0.0	0.0
A-6 Row 8	1.1	0.0	A-7 Row 2	.3	.3
A-7 Row 7	1.2	3.8	A-8 Row 7	.4	0.0
A-7 Row 8	1.5	6.5	A-8 Row 8	.7	.5
A-8 Row 1	3.5	2.3	A-9 Row 7	0.0	0.0
A-8 Row 2	3.8	.6	A-9 Row 8	*[5]	*
A-9 Row 1	1.6	1.2			
A-9 Row 2	1.2	.5			

TABLE 2. Incidence of Diplodia shoot blight in bed rows treated with Benlate fungicide and untreated bed rows - Section C, Wilson Nursery.

UNSPRAYED			SPRAYED 1991		
Location	Disease	Incidence	Location	Disease	Incidence
C-23 Row 1 Beds 11,12 east[6]		4.8	C-23 Row 1 Beds 7,8	east	.4
C-23 Row 2 Beds 11,12 east		1.3	C-23 Row 2 Beds 7,8	east	.8
C-22 Row 8 Beds 6,7 east		.4	C-22 Row 8 Beds 2,3	east	0.0
C-22 Row 7 Beds 6,7 east		.9	C-22 Row 7 Beds 2,3	east	0.0
C-24 Row 7 Beds 6,7 east		.3	C-24 Row 7 Beds 2,3	east	0.0
C-24 Row 8 Beds 6,7 east		.4	C-24 Row 8 Beds 2,3	east	.4
C-25 Row 7 Beds 26,27 east		.3	C-25 Row 7 Beds 30,31	east	0.0
C-25 Row 8 Beds 26,27 east		.9	C-25 Row 8 Beds 30,31	east	1.1
C-27 Row 1 Beds 3,4 west		2.8	C-27 Row 1 Beds 7,8	west	0.0
C-27 Row 2 Beds 3,4 west		1.6	C-27 Row 2 Beds 7,8	west	0.0
C-28 Row 8 Beds 10,11 west		1.9	C-28 Row 8 Beds 6,7	west	0.0
C-28 Row 7 Beds 10,11 west		1.7	C-28 Row 7 Beds 6,7	west	0.0
C-29 Row 7 Beds 7,8 west		.8	C-29 Row 7 Beds 4,5	west	1.5
C-29 Row 8 Beds 7,8 west		1.1	C-29 Row 8 Beds 4,5	west	0.0
C-30 Row 7 Beds 12,13 west		3.8	C-30 Row 7 Beds 8,9	west	2.0
C-30 Row 8 Beds 12,13 west		2.4	C-30 Row 8 Beds 8,9	west	.4

[1] All plots were located at the east ends of the rows, the second bed from the end.

[2] Percent of seedlings with symptoms of Diplodia shoot blight calculated from 4, 6" x 4' plots/location.

[3] Rising 1-0.

[4] Rising 2-0.

[5] Seedlings damaged by wind.

[6] Beds 11 and 12 from the east end of the section.

APPENDIX B

1991 Red Pine Seed and Cone Insects: 1991 Pheromone Trapping Program Summary

by Mark Guthmiller and David Hall[1]

This is a cooperative project with USDA Forest Service, State and Private Forestry, and Forestry Canada, Forest Pest Management Institution.

The attractants for the red pine coneborer, *Eucosma monitorana*, and the webbing coneworm, *Dioryctria disclusa*, failed to attract enough adult moths to allow a determination. This could be the result of lack of attractance of the pheromones or very low populations of the target insects.

The red pine shoot moth, *Dioryctria resinosella*, (*D. resinosella*) has emerged as a major pest of red pine cones because of its habit of periodically killing large numbers of the shoots bearing the first year conelets near the tree tops where the majority of the cones occur. The 1990 results showed that the *D. resinosella* adult flight period lasts about two months. This is very surprising in light of the fact that the observed population and adult emergence lasts only about 2 to 3 weeks.

To learn more about the flight period and the identity of the moths caught in the *D.resinosella* traps a bait age test was conducted and late flying moths were examined closely. Many of the late-flying moths are suspected to be *D. banksiella*, a closely related species associated with jack pine. It is possible, therefore, that the apparent two-month flight period of *D. resinosella* is nonexistent; we will have to learn to separate the two species in the traps. In early August, new baits were tested against similar baits that had been in the field for a month. The age of the bait turned out to have no effect.

The influence of trap height *D. resinosella* trap catch was tested by placing traps at different heights in the crown. The higher traps caught decidedly more moths and lower but very exposed traps at the edges also caught more than the internal traps at lower crown levels. It appears that the observed distribution of damaged shoots at tree tops and lower levels of edge trees reflects the adult flight habits.

Five different chemical combinations were tested in order to confirm the identity of the pheromone of *D. resinosella*. Two of the five were decidedly more attractive than the unbaited control traps.

A temperature recorder was placed in the Avoca red pine seed orchard in late March and removed in September in order to relate insect development to accumulated temperature units.

The results of the 1989-1991 pheromone trapping tests will be reported in: Grant, G.G., S.A. Katovich, D.J. Hall, D. Lombardo and K.N. Slessor. 1992. Sex pheromone identification and trapping of the red pine shoot moth, *Dioryctria resinosella* Mutuura (*Lepidoptera:Pyralidae*), which has been submitted to ENVIRONMENTAL ENTOMOLOGY.

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[1]Forestry Technician and Forest Entomologist, Wisconsin Department of Natural Resources.